DOCUMENT RESUME

ED 154 021 95 TM 007 034

AUTHOR Hulten, Burma H.; DeVries, David L.
TITLE Team Competition and Group Practice: Effects on Student Achievement and Attitudes. Report No. 212.
INSTITUTION Johns Hopkins Univ., Baltimore, Md. Center for Social Organization of Schools.
SPONS AGENCY National Inst. of Education (DHEW), Washington, D.C.
PUB DATE May 76
CONTRACT NE-C-00-3-0114
NOTE 39p.; For related documents, see ED 093 883, 128 691, 133 315, and TM 007 034

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Academic Achievement; Affective Objectives; Classroom Games; *Competition; Expectation; Grade 7; Group Discussion; *Group Dynamics; Grouping (Instructional Purposes); High Achievers; Individual Study; Junior High Schools; Low Achievers; Mathematics Instruction; Peer Relationship; *Rewards; *Student Attitudes; Student Motivation; Success Factors; Teaching Techniques; *Teamwork
IDENTIFIERS *Teams Games Tournament

ABSTRACT

To determine the relative contribution of team competition and peer group practice sessions to the effectiveness of a classroom instructional technique, Teams-Games-Tournament (TGT), 299 seventh grade mathematics students participated in an experiment varying reward system (team vs. individual competition) with practice mode (group vs. individual). An external control group was used. Dependent variables included mathematics achievement on the Stanford Achievement Test (SAT) and four student attitude scales. Results indicated that Team Competition students improved significantly more on the SAT, attached more importance to game success, and reported a higher level of peer group interest and peer pressure to do well at the game than did Individual Competition students. Group Practice students did not differ significantly in their performance on the SAT from Individual Practice students, but did attach less importance to game success than students who practiced individually. When compared to the external control group, Team Competition students (the standard TGT treatment) indicated significantly greater improvement on the SAT, reported a higher expectancy of success at the game, attached more importance to game success, reported more interest by peers in their performance, and were more satisfied with the game task. In conclusion, the team reward structure is more important than group practice sessions; in terms of expectancy value theory, team structure alters students' perceived probability of success without affecting the importance of that success. (Author/CP)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

Center for Social Organization of Schools

ED154021

Report No. 212

May 1976

TEAM COMPETITION AND GROUP PRACTICE: EFFECTS ON STUDENT ACHIEVEMENT AND ATTITUDES

Burma H. Hulten and David L. DeVries

TM007 034

The Johns Hopkins University

STAFF

Edward L. McDill, Co-director

James M. McPartland, Co-director

Karl Alexander

Alta Lou Bode

Lloyd Bond

Denise C. Daiger

Joyce L. Epstein

James J. Fennessey

Gary D. Gottfredson

Linda S. Gottfredson

Ellen Greenberger

Larry J. Griffin

Edward J. Harsch

John H. Hollifield

Lawrence F. Howe

Nancy L. Karweit

Hazel G. Kennedy

Iris L. Raigns

James M. Richards

Robert E. Slavin

Julian C. Stanley

John S. Wodarski

TEAM COMPETITION AND GROUP PRACTICE:

EFFECTS ON STUDENT ACHIEVEMENT AND ATTITUDES

CONTRACT NO. NE-C-00-3-0114

Burma H. Hulten[1]

David L. DeVries[2]

REPORT NO. 212

MAY 1975

[1]Burma H. Hulten is now with the U.S. Office of Education, Washington, D.C.

[2]David L. DeVries is now with the Center for Creative Leadership, Greensboro, N.C.

Published by the Center for Social Organization of Schools, supported in part as a research and development center by funds from the United States National Institute of Education, Department of Health, Education and Welfare. The opinions expressed in this publication do not necessarily reflect the position or policy of the National Institute of Education, and no official endorsement by the Institute should be inferred.

The Johns Hopkins University

Baltimore, Maryland

Introductory Statement

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through three programs to achieve its objectives. The Schools and Maturity program is studying the effects of school, family, and peer group experiences on the development of attitudes consistent with psychosocial maturity. The objectives are to formulate, assess, and research important educational goals other than traditional academic achievement. The program has developed the Psychosocial Maturity (PSM) Inventory for the assessment of adolescent social, individual, and interpersonal adequacy. The School Organization program is currently concerned with authority-control structures, task structures, reward systems, and peer group processes in schools. It has produced a large-scale study of the effects of open schools, has developed the Teams-Games-Tournament (TGT) instructional process for teaching various subjects in elementary and secondary schools, and has produced a computerized system for school-wide attendance monitoring. The School Process and Career Development program is studying transitions from high school to post secondary institutions and the role of schooling in the development of career plans and the actualization of labor market outcomes.

This report, prepared by the School Organization Program, presents a study of the relative contribution of team competition and group practice sessions to the effectiveness of the Teams-Games-Tournament instructional process.

Abstract

A study was conducted to determine the relative contribution of team competition and group practice sessions to the effectiveness of a classroom instructional technique--Teams-Games-Tournament (TGT). Two hundred ninety-nine (299) seventh grade students in ten mathematics classes participated in a ten-week field experiment. A 2 x 2 (reward system and practice mode) factorial design with an external control group was used. The two levels of reward system were Team Competition and Individual Competition. The two practice modes were Group Practice and Individual Practice. Dependent variables included mathematics achievement (Stanford Achievement Test--SAT) and four student attitude scales. The results indicated: (1) the Team Competition students improved significantly more on the SAT, attached more importance to game success, and reported a higher level of peer group interest and peer pressure to do well at the game than did the Individual Competition students; (2) the Group Practice students did not differ significantly in their performance on the SAT from the Individual Practice students, but did attach less importance to game success than students who practiced individually; (3) when compared to the external control group, the Team Competition students (the standard TGT treatment) indicated significantly greater improvement on the SAT, reported a higher expectancy of success at the game, attached more importance to game success, reported more interest by peers in their performance, and were more satisfied with the game task. An expectancy-value motivational theory was used to interpret the results.

Team Competition and Group Practice:

Effects on Student Achievement and Attitudes

The educational community has long sought means to maximize the academic achievement of students. Large amounts of money (both public and private) have been invested in the development of innovative programs and practices which seek to raise student performance through new teaching techniques and curriculum reforms, e.g., teaching machines, use of computers, educational television, team teaching, open classrooms, individualized instruction, "new math," ethnic studies, etc. To date, these efforts have been largely unsuccessful.

Recently, however, some educators (Kagan, 1974; McKeachie, 1974), have recognized the role of two mediating variables in the learning process--a student's expectancy of success, and the importance he attaches to that success. Many students come to school placing a relatively low value on academic achievement. Home backgrounds in which parents do not emphasize educational goals, and the influence of peer groups which frown upon academic achievement (Coleman, 1961) are often cited as reasons. In addition, the relative grading system typically employed in the conventional classroom provides that only a small percentage of students will receive an "A," or excellent, for their work. Under such grading structures a few students have a virtual monopoly on high grades whereas others have almost no chance of obtaining them, resulting in few success opportunities for most students. Although programmed instruction and criterion-referenced materials, for example, seek to eliminate this problem, altering a student's probability of success is only effective if attaining that success is of importance to him.

Innovations which do not substantially affect both the value a student attaches to academic achievement and his probability of such achievement may thus prove to be no better than the traditional techniques which educators are seeking to improve.

A substantial literature (see DeVries & Mescon, 1975, for review) is now available which addresses the question of the efficacy of Teams-Games-Tournament (TGT), a classroom management system which alters the reward-task structure in which students operate. TGT consists of a unique combination of individual and team competition, instructional games, and team cooperation through peer tutoring. The present study conceptualized TGT effects using an expectancy-value theory of student motivation (Atkinson, 1966; Edwards, 1955; Rotter, 1964). "Expectancy of success" and "incentive value of success" were viewed as intervening variables in the impact of TGT on student achievement. The purpose of the study was to estimate the relative contribution of team competition and peer group practice sessions (both TGT components) to the effectiveness of TGT. The test took place in ten seventh grade mathematics classes and focused on arithmetic computation skills.

Description of Teams-Games-Tournament (TGT)

TGT restructures the classroom learning environment in the following ways:

Student teams. Each class is divided into four-member teams. Pupils are assigned to teams so that high, low, and middle achieving students are represented. This procedure serves to equalize the academic resources across teams. Team membership is also balanced in terms of sex and ethnic background.

To promote team identification, each team participates in the selection of a team name, and teammates are assigned adjacent seats. Team performance is defined by comparing each team's score with that of the other teams in the classroom. Team standing is based upon the team's season record (the sum of the team's scores over all game tournaments). Informal team practice sessions are scheduled to allow teammates to review relevant material and engage in peer tutoring. Pupils are given particular assignments to complete, and are encouraged to help each other so as to improve their game performance.

Instructional games. Competition centers on instructional games which require students to use knowledge taught during regular classroom periods. To win at the games, the students must acquire the concepts or skills addressed by the curriculum unit. Each pupil is required to make an individual contribution, and must successfully defend his answer or solution before being awarded game points.

Tournaments. Game-playing sessions are held at least weekly. Each team member is assigned to a game table at which the student competes against two representatives (of comparable achievement level) of other teams. Team members thus do not play together. At the end of every tournament (usually should be 30-45 minutes), the high scorer at each game table contributes six points to his team score; the middle scorer contributes four points; and the low scorer contributes two points.

Newsletters. Team standings are reported in the form of a newsletter following each tournament. Each player is listed according to team membership.

Individual and team tournament scores are recorded. Teams are ranked according to their season records. A commentary section congratulates high ranking teams and the teams with the highest scores for the previous tournament. For a more detailed description of TGT classroom procedures, see Fennessey, DeVries, and Edwards (1974).

Prior Research with TGT

Three previous TGT studies (DeVries & Edwards, 1974; Edwards & DeVries, 1972; Edwards, et al., 1972) employed mathematics as the curriculum unit. The results of these studies suggest a consistently positive effect of TGT (or its components) on those math skills taught during the experimental periods (using treatment-specific measures of achievement). Inconsistent treatment effects were obtained, however, on standardized achievement measures. The specific effects of team competition (compared with individual competition) have been examined in one prior TGT study (DeVries & Edwards, 1973; Edwards & DeVries, 1972). Although no effects of team competition on achievement in mathematics were observed, positive effects were achieved on such classroom processes as peer tutoring and expressions of mutual concern. The effects of the team practice component of TGT have not been directly examined. In one study, however, DeVries and Edwards (1973) indicated group practice sessions were important because considerable informal peer tutoring occurred during such sessions.

Theoretical Framework and Hypotheses

TGT represents a unique combination of individual and team competition. At the game tables pupils are differentially rewarded (with either six,

four, or two points) for engaging in an activity which requires an extremely low level of task interdependence. For example, in the present study each pupil, independent of his competitors, developed a set of math solutions. At the team level, however, teammates are rewarded equally (i.e., by receiving the same team score and the same team standing for their game performance). Small group research (Michaels, 1975; Miller & Hamblin, 1963) suggests that productivity at tasks requiring a low level of interdependence is higher in competitive situations (where individuals are rewarded differentially according to their relative achievements) than in the team situation (where teammates are rewarded equally no matter what their individual performance).

The present study seeks to determine the role of team competition in TGT and to explain why the team reward structure does not seem to dilute the motivating effects of the individually-based competitive reward system in operation at the game tables. Two explanations are explored. The first postulates the existence of team-related motivational effects which supplement rather than dilute the motivational effects of individual competition. An alternative explanation postulates that the competitive team structure results in the peer tutoring of low achievers by high achieving teammates during the team practice session, thereby increasing the level of achievement of both.

A number of motivational models of behavior belong to a class of expectancy-value theories (see Feather, 1966, for review). According to this model, motivation--as expressed in the direction, magnitude, and persistence of behavior--is a function of two variables: the perceived probability (i.e., expectancy) of success at a particular task, and the incentive value or importance of that success.

Individual competition at the game tables, as defined by the tournament structure, was hypothesized to affect students' perception of the probability of success at the instructional game. The Atkinson model (1966) postulates that achievement motivation is highest at intermediate levels of probability, that the low achieving student fails to achieve because the probability of success is too low, and that the high achieving student does not exert the extra effort needed to achieve at an even higher level because the probability of success is too high. The TGT tournament structure provides that low achieving students need only outperform other low achieving students to win at the game, whereas high achieving students in the TGT classroom must outperform other high achieving students to be game winners. Consequently all students within a class have an approximately equal probability of success centered in the intermediate (rather than extreme) range of difficulty.

The team component of TGT was presumed to increase the incentive value which pupils attach to success at the instructional game in two ways: (1) interdependence and intergroup competition was thought to foster identification with the team, and the development and acceptance of group goals, one of which is winning at the instructional game, and (2) identification with a team was presumed to lead to a changed classroom normative climate such that success at an instructional game is rewarded by classmates rather than ignored or discouraged. Thus, students should enjoy the game playing activity more when they play as representatives of a team than when they represent only themselves.

In sum, individual competition at the game tables is presumed to significantly alter students' probability of success, but without affecting

the importance they attach to that success. Team membership and team competition are presumed to increase the importance of winning at the game by providing an additional source of reinforcement for a pupil's academic efforts--the encouragement and support provided by team members. The present study hypothesized that the achievement motivation (expectancy of success x incentive value of success) and, therefore, the achievement level of TGT students would be enhanced by the team component rather than dissipated as would have been predicted by the small group research.

To assess the effects of the team component of TGT, two experimental groups were created. The Individual Competition group participated in game-playing tournaments but did not play as representatives of a team. Their class standing depended solely upon their own individual season record. The Team Competition group participated in game-playing tournaments as representatives of competing teams. The following five hypotheses are derived from the previous discussion:

Hyp. 1.1--Student Achievement. Team Competition students will improve significantly more on a measure of academic achievement than students in the Individual Competition group.

Hyp. 1.2--Incentive Value of Success. Team Competition students will attach significantly greater importance to game success than students in the Individual Competition group.

Hyp. 1.3--Normative Climate/Peer Pressure. Team Competition students will perceive significantly greater peer group pressure to do well at the game than will Individual Competition students.

Hyp. 1.4--Student Satisfaction. Team Competition students will be significantly more satisfied with the game-playing

activity than students in the Individual Competiton group.

The impact of the peer tutoring component of TGT was also assessed in this present study. Low motivation may not be the only reason students do poorly in school. Some students require repeated explanations and more prompting to master the subject matter under study. It was hypothesized that the opportunity to peer tutor in the TGT structure serves to augment the amount of instruction low achieving students receive and helps high achieving students overlearn and synthesize material previously mastered. It was also hypothesized that students were more likely to engage in peer tutoring if there were a compelling reason. For example, Hamblin, et al. (1971), and Wodarski, et al. (1971), employed group contingencies in the classroom, and noted a great deal of spontaneous peer tutoring in unstructured group practice sessions.

To assess the effects of the peer tutoring component of TGT, Individual Practice and Group Practice conditions were created. Students in the Individual Practice group completed all assignments individually, and received no help from their classmates. Students in the Group Practice condition were given the opportunity to work together. In the Team Competition/Group Practice condition, teammates were able to tutor each other. In the Individual Competition/ Group Practice condition, students were assigned to tutoring groups, and were encouraged to help each other with classwork assignments.

Two hypotheses follow from the previous discussion:

Hyp. 2.1--Student Achievement. Group Practice students will improve significantly more on a measure of achievement than students in the Individual Practice group.

Hyp. 2.2--Student Achievement. Students in the Team Competition/Group Practice condition will improve significantly more on a measure of academic achievement than Individual Competition/Group Practice students.

Method

Subjects

A ten-week field experiment was conducted during the spring semester of 1973. Two hundred ninety-nine (299) seventh grade students in ten mathematics classes from a middle school in a working-class suburb of Baltimore participated in the study. Fifty percent of the students were males. All but one student were Caucasian. The Stanford Achievement Test (SAT), Arithmetic Computation subtest (Intermediate II), was administered as a pretest in March 1973 and provided an estimate of student achievement levels prior to the onset of the study. The average grade equivalent score for the participants was 6.1. Five of the ten classes had been designated by the school as "average math ability," and their mean grade equivalent was 6.6. The remaining five classes had been designated as "below average math ability," and their mean grade equivalent score was 5.4.

Design

A 2 x 2 design with an external control group was employed. The two independent variables were Reward System (Individual Competition vs. Team Competition) and Practice Mode (Individual Practice vs. Group Practice). A traditional reward/task structure was employed in the fifth treatment cell. Ten intact mathematics classes, taught by two teachers, participated in the

field experiment. Classes were randomly assigned to treatments, stratifying on both teacher and class achievement level. Two classes from each teacher were assigned to diagonal treatment groups to allow for the testing of Reward and Practice main effects. Note, however, that the Reward x Practice interaction effect is confounded with the teacher effect.

Independent Variables

Reward system: Individual Competition vs. Team Competition. Students in the Individual Competition treatment participated in weekly game-playing tournaments as did their counterparts in the Team condition. However, instead of playing as representatives of a team, students in this group represented only themselves. They were not linked to other students by a group-based reward system but were rewarded on the basis of their own game performance. Students received newsletters which listed their latest tournament scores (six, four, or two) and ranked them according to their individual season record (the sum of all their tournament scores). Table winners were given special recognition as were the students with the five highest season records. The tournament structure insured that students of all ability levels were represented in the top five positions.

Students in the Team Competition group were assigned by the experimenter to four-member teams at the beginning of the study. Team assignments were based on math scores on the Iowa Test of Basic Skills (administered by school personnel at the beginning of the academic year) and sociometric information collected from the students indicating their choice of teammates. Team assignments were made so that high, low, and middle achieving students would be included on each team. Students participated in game-playing tournaments

as representatives of their team competing against pupils of comparable math achievement from other teams. In contrast to the Individual Competition treatment, students in the Team Competition group were linked to other students by an ongoing, group-based reward system. Their newsletters emphasized the team score (the sum of the scores of the team members), and the team's season record (the sum of all of the teams' tournament scores). A commentary section gave special recognition to the first and second place teams within each league, and the teams with the highest scores for the previous tournament.

Practice mode: Individual Practice vs. Group Practice. Students in the Individual Practice group were not permitted to help each other with classwork assignments. Students completed teacher-devised worksheets and blackboard assignments on their own, and these were checked by the class, as a whole, in a question-and-answer period conducted by the teacher.

Students in the Group Practice condition were encouraged by the teacher to work together on classwork assignments in order that low performing students could receive added instruction from their more knowledgeable peers. Since the purpose of the study was to test the effects of the team practice session as it operated in TGT, a formal tutoring structure was not employed. Tutors and tutees were not designated, nor was a formal monitoring system provided. Students in the Team Competiton/Group Practice condition were permitted to peer tutor their teammates as the need arose. Students in the Individual Competition/ Group Practice condition were assigned to peer tutoring groups on the basis of math scores obtained on the Iowa Test of Basic Skills and sociometric information collected from students indicating with whom they wanted to work. The composition of the practice groups was exactly analogous to that of teams except that members of practice groups differed in terms of the incentives for peer

tutoring. In the Team condition, the group-based reward system provided an incentive for intra-team tutoring, namely, the prospect of increasing individual and, therefore, team scores. No such incentive existed in the Individual Competition treatment.

All students in the experimental groups played an academic game in accordance with the tournament component of the Teams-Games-Tournament technique. Twelve game-playing sessions of one-half hour or more were played during the course of the ten-week study. All classes played the game on the same day, typically a Wednesday and/or a Friday. The remaining class time was devoted to teacher-directed, group-level interaction or the completion of classwork assignments.

External control group. Although the major hypotheses of the study focus on the four TGT variations created in the 2 x 2 design, an external Control group was also included. Addition of such a Control group provides a test of whether any of the TGT variations result in differential effects on students when compared with more traditional treatments. The present study controlled for a possible Hawthorne Effect by incorporating novel activities into the Control treatment. Control students performed a game-like task similar to that used in the experimental classes. The tasks were labeled "games" by the teachers. On tournament days Control students engaged in these game-like activities, with the five students receiving the highest scores in each class being given special recognition by the teacher. In general, the Control treatment involved grading on the curve (an individual competition reward structure), with an instructional format based on teacher-directed, classroom-level learning activities.

Curriculum Unit

Since the study was conducted during the last three months of the school year, a curriculum unit was selected which reviewed material previously taught. This material consisted of addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals. To meet the goals of the review unit, a modified version of the math game Tuf (Avalon-Hill Company, Baltimore, Maryland) was used. The game task consisted of using sets of numbers and operations to form equations equal to specified number goals. Points were awarded on the basis of the length of each equation.

Dependent Variables

Mathematics achievement. To measure computational skills, pretest and posttest scores were obtained on the Arithmetic Computation subtest of the Stanford Achievement Test (SAT), Intermediate II. Raw scores were used in the analyses.

Student attitudes. Four student attitude scales were administered on a posttest only basis. A four-point Likert-type response format was used. The four scales were: (1) Perceived Probability of Game Success, a five-item scale with such items as "I have a good chance of winning at the game;" (2) Incentive Value of Game Success, a four-item scale with such items as "It is important to me to win at the game;" (3) Peer Pressure for Game Success, a four-item scale with such items as "Other students think it is important for me to work hard at the game;" and (4) Game Satisfaction, a five-item scale with such items as "I like the game." Interscale correlations were calculated, with the average interscale correlation being .26 (range of .10 to .35), indicating the four scales measure relatively distinct constructs.

Results

A general linear regression model was used to analyze the achievement and attitude data (Cohen, 1968; Walberg, 1971). Two separate analyses were performed. The first involved testing the six hypotheses concerning the effects of the team and peer tutoring components of TGT. The second incorporated the fifth treatment cell in an analysis of the effects of TGT variations versus a traditional instructional technique.

Effects of Reward System and Practice Mode

Seven independent variables were used to test the reward and practice effects. F-tests were performed on the incremental R^2 associated with each additional independent variable, as described by Cohen (1968). Independent variables were entered into the regression equation in a predetermined order: covariates first, treatment variables next, and certain selected interaction effects last. To control for student knowledge gained prior to initiation of the study, two covariates were employed in the analysis: students' pretest score on the Stanford Achievement Test, and a Class Ability factor (a dichotomous scale of average versus below average math ability).

Insert Tables 1 and 2 about here

Table 1 summarizes the results of the regression analysis on the raw scores of the Arithmetic Computation subtest of the Stanford Achievement Test. The significant SAT Pretest main effect ($F = 481.18$; $df = 1,225$; $p < .01$) and the significant Class Ability effect ($F = 16.22$; $df = 1,224$; $p < .01$) indicate that the performance level of students prior to the onset of the study was a major predictor (explaining 67% of the variance) of their level of performance at the end of the study.

The significant Reward main effect ($F = 5.64$; $df = 1,223$; $p < .05$) indicates that differential learning occurred in the two Reward groups. Inspection of the pretest and posttest treatment group means (see Table 2) indicates that students in the Team Competiton group improved significantly more on the SAT than students in the Individual Competition group. This is a confirmation of the Reward main effect postulated in Hypothesis 1.1. Note that these results were obtained with a three-month review unit.

Contrary to prediction, the results in Table 1 indicate that neither a Practice main effect (Hyp. 2.1) nor a Reward x Practice interaction effect (Hyp. 2.2) were obtained for the SAT.

The significant Pretest x Practice interaction ($F = 6.25$; $df = 1, 219$, $p < .01$) indicates that Group Practice was not equally beneficial to students of all ability levels. The computation of the within-treatment regression lines for both the Group Practice and Individual Practice conditions indicates that pupils in the Group Practice condition with low pretest scores on the SAT improved significantly more on the posttest than low achievers in the Individual Practice condition. A slightly opposite trend was noted for high achieving students.

Insert Table 3 about here

Table 3 summarizes the results of the regression analysis for the treatment-specific attitude scales. With respect to Perceived Probability of Game Success: (1) prior math performance (i.e., SAT Pretest score and Class Ability level) did not significantly influence a student's perception of the chances of winning at the game; (2) neither Reward System (Individual

Competition vs. Team Competition) nor Practice Mode (Individual Practice vs. Group Practice) affected student perception of the difficulty level of the game task; and (3) the perception of low performers and high performers with respect to the chances of being a game winner was not differentially affected by the treatment conditions (i.e., there was not Pretest x Reward or Pretest x Practice effect). This pattern of nonsignificant results reflects the constancy of the individual competitive structure across the four treatment groups. Differences on Perceived Probability of Success were expected only for comparison with the Control group.

The significant Reward main effect ($F = 5.44$; $df = 1,207$; $p < .05$) on the scores of the Incentive Value of Game Success scale indicates that, as predicted (Hyp. 1.2), students in the Team Competition group (mean score = 11.00, on an ascending scale from four to sixteen with a neutral point of 10.00) attached more importance to winning the game than pupils in the Individual Competition group (mean score = 10.20).

The unexpected Practice main effect ($F = 4.77$; $df = 1,206$; $p < .05$) was due to participants in the group practice sessions scoring significantly lower on the Incentive Value of Success scale than those who practiced individually (see Table 2).

The absence of an SAT Pretest main effect and a Class Ability main effect on the scores of the Incentive Value of Success scale indicate that, unlike high grades and teacher approval, the desire to achieve success at the game was not limited to one segment of the class.

The significant Reward main effect ($F = 119.25$; $df = 1,207$; $p < .01$) on the scores of the Peer Pressure for Game Success scale indicates, that as predicted

(Hyp. 1.3), students in the two reward conditions differed in their perceptions regarding peer group interest in their game performance. Individual Competition students had an average score of 8.80 (in an ascending scale from four to sixteen with a neutral point of 10.00) indicating the absence of peer group interest in or pressure to do well at the game. Team Competition students had an average score of 11.96, indicating that these students believed their classmates had a positive interest in their game success. Note that 35% of the variation in scores on this normative climate measure is accounted for by the Reward factor.

Hypothesis 1.4 predicted that students in the Team Competition group would express more satisfaction with the game activity than students in the Individual Competition group. As Table 3 indicates, this hypothesis was not confirmed. Data analysis revealed a nonsignificant Reward main effect.

The unpredicted SAT Pretest x Reward interaction effect ($F = 5.26$; $df = 1,204$; $p < .05$) for Game Satisfaction indicates that the Reward structure differentially affected low and high performing students. Examination of the within-treatment regression lines for the two levels of the Reward factor indicates that low performers on the SAT Pretest enjoyed the math game more when they played as representatives of a team than when they played as isolated individuals. This effect occurred despite the fact that, on the average, students in the Team Competition group reported greater peer pressure to do well at the game than students in the Individual Competition group. Note that satisfaction with the game task was high for all students in the experimental groups. The average satisfaction score was 16.35 (on an ascending scale from five to twenty with a neutral point at 10.00).

In summary, the analyses indicated the following: (1) in comparison to Individual Competition students, Team Competiton students improved more on a standardized measure of math achievement (Hyp. 1.1 confirmed), attached more importance to successful performance at the instructic al game (Hyp. 1.2 confirmed), reported a higher level of peer group interest in their game performance (Hyp. 1.3 confirmed), but did not report more satisfaction with the game task (Hyp. 1.4 not confirmed); (2) when compared to Individual Practice students, the Group Practice students did not differ in their performance on a standardized measure of math achievement (Hyp. 2.1 and 2.2 not confirmed).

Effects of Team Competition vs. Control

Since the 2 x 2 analysis indicated significant Reward System effects on math achievement and student attitudes (Team Competition > Individual Competition), and the two hypotheses related to Practice Mode (Individual vs. Group Practice) were not confirmed, it was decided to compare the achievement and attitudes of students in the two Team Competition groups with students in the Control group. The Team Competition/Group Practice condition, in particular, represents a complete operational form of TGT as defined by Fennessey, DeVries, and Edwards (1974).

Insert Tables 4 and 5 about here

Table 4 summarizes the results of the regression analysis on the raw scores of the Arithmetic Computation subtest of the SAT. Table 5 contains the treatment group means and standard deviations for the achievement and attitude measures. The significant SAT Pretest main effect ($F = 259.39$; $df = 1,169$; $p < .01$) and the significant Class Ability Factor ($F = 9.59$;

df = 1,168; $p < .01$) reported in Table 4 indicate that the pretest performance level of students was a major predictor (explaining 63% of the variance) of their level of performance at the end of the study. The significant Treatment main effect ($F = 6.27$; df = 1,167; $p < .05$) indicates that differential learning occurred in the Experimental and Control groups. Inspection of the treatment group means listed in Table 5 indicates that students in the Team Competition classes improved significantly more on the SAT than students in the Control group.

Insert Table 6 about here

Table 6 summarizes the results of the regression analysis on the scores of the treatment-specific attitude measure. Significant Treatment effects were obtained on each of the four attitude scales: Perceived Probability of Game Success ($F = 20.94$; df = 1,167; $p < .01$), Incentive Value of Game Success ($F = 27.56$; df = 1,167; $p < .01$), Peer Pressure ($F = 146.65$; df = 1,167; $p < .01$). Inspection of the treatment group means listed in Table 5 indicates that Team Competition students scored significantly higher on each of the four scales than did Control students. The treatment effects on all attitude scales were strong, accounting for 11%, 14%, 47%, and 15% of the variance, respectively.

In addition, Pretest x Treatment interaction effects were obtained on all four attitude scales: Perceived Probability of Game Success ($F = 19.24$; df = 1,166; $p < .01$), Incentive Value of Game Success ($F = 56.33$; df = 1,166; $p < .01$), Peer Pressure ($F = 38.88$; df = 1,166; $p < .01$), and Game Satisfaction ($F = 91.19$; df = 1,166; $p < .01$). The within-cell regression lines (calculated separately for the Team Competition and for the Control groups) revealed a

consistent trend across the four dependent variables. Students in the Team Competition classes with low pretest scores on the SAT scored higher on the attitude measures than low performing students in the Control group. The differences in scores between high performing students in the Experimental and Control classes were less dramatic and in some cases nonexistent. Note that the Pretest x Treatment interaction effects on all four attitude scales were strong, accounting for 9%, 22%, 10%, and 29% of the variance, respectively.

In summary, when compared to the Control group, the Team Competition students increased more in math achievement, perceived a higher probability of game success, attached more importance to winning the game, perceived more peer pressure to do well at the game, and were more satisfied with the game task. The differences in attitude scores between Experimental and Control classes were more apparent among low achieving students than among high achievers.

Discussion

The present study was conducted to determine the relative contribution of team competition and peer group practice sessions to the effectiveness of the Teams-Games-Tournament (TGT) technique. The results of the study suggest the reward system is the more important structural component. Contrary to prediction, Practice Mode (Individual vs. Group Practice) differentially affected high and low achieving students. That is, while low achievers benefited from group practice sessions, high achievers did not. This interaction effect may be due to the nature of the interaction during the group practice session, namely, high achieving students tutoring low achieving students. Such tutoring may account for the observed positive impact on achievement for initially low achieving students only. Unfortunately, no behavioral data was collected during

the practice sessions, consequently, the hypothesis remains merely a conjecture. More formal monitoring of student interaction during the group practice sessions would have allowed a more rigorous test of Hypotheses 2.1 and 2.2.

The hypothesized effectiveness of the Team component of TGT was supported in the present study. Students in the Team Competition classes improved significantly more on the SAT than students in the Individual Competition group. Analysis of the data from the attitude scales provides some explanation for the Team effect. Students in the Team Competition group attached more importance to game success than students in either the Individual Competition group or the Control. In terms of expectancy value theory, the motivation (expectancy of success x incentive value of success) of students was therefore higher in the Team Competition group than in the Individual Competition group.

That team members also reported more peer group interest and peer pressure to do well at the game suggests a possible causal chain. Team Competition, as defined by TGT, incorporates a group-based reward system and interteam competition. The resulting reward interdependence should develop peer group norms supportive of game success. These norms, in turn, should alter individual values. The data indicate that students in the Team Competition classes reported peer group interest in their game-playing performance. Slavin, et al. (1975) analyzed this question more thoroughly (using sociometric data from the present study). They report that academic success in the Team Competition classes resulted in more frequent selection on sociometric friendship dimensions, whereas this trend was not present in the Individual Competition classes. These results support directly the contention that Team Competition in the classroom fosters peer group norms which support academic performance.

In sum, the team reward structure adds to, rather than diminishes, the motivating effects of the individually-based competitive reward system in operation at the game tables. In terms of expectancy value theory, the tournament structure alters students' perceived probability of success, but without affecting the importance of that success. It is the Team component of TGT which fills the latter role. These changes in reward structure are especially important to low performing students. The Pretest x Treatment interactions, in the comparison of the Team Competition classes with the Control, indicate the differential effect of the treatment on high and low achieving students.

The comparison of Team Competition with Control constitutes a replication of the three earlier TGT studies conducted in mathematics classes (Edwards, et al., 1972; Edwards & DeVries, 1972, 1974). As noted earlier, the earlier studies yielded positive effects, particularly on treatment-specific measures of achievement. The present study, with positive TGT effects on a standardized achievement measure, provides a useful addition to the TGT literature.

TGT represents a radical alteration in the reward/task structure in the classroom. Since most high achieving students are able to learn in the conventional classroom environment, it is not surprising that the team, game, and tournament components of TGT have more profound effects on the low performing student. The data suggest that these students perceive a more drastic change in their probability of success, the importance they attach to such success, the interest of classmates in their academic performance, and their enjoyment of an academic task than occurs for the high achieving student. Note, however, that these changes do not have an adverse effect on the achievement or attitudes of the higher achieving students.

TGT is based on the premise that restructuring the situational parameters defining the classroom learning environment is an effective method of increasing the academic achievement of all students. This study focused only one possible instructional activity, namely, the playing of an academic game. It would be interesting to attempt to extend these findings by applying the team and tournament components of TGT to other classroom activities, such as tests and homework assignments.

References

Atkinson, J. W., & Feather, N. T. (Eds.). A theory of achievement motivation. New York: John Wiley & Sons, Inc., 1966.

Cohen, J. Multiple regression as a general data-analysis system. Psychological Bulletin, 1968, 70, 426-443.

Coleman, J. W. The adolescent society. New York: The Free Press of Glencoe, 1961.

DeVries, D. L., & Edwards, K. J. Learning games and student teams: Their effects on classroom process. American Educational Research Journal, 1973, 10, 307-318.

DeVries, D. L., & Edwards, K. J. Instrumentality theory applied to cooperation and competition in the classroom. Paper presented at the meeting of the American Psychological Association, New Orleans, August 1974.

DeVries, D. L., & Mescon, I. T. Teams-Games-Tournament: Its effects on students when using a generic gaming structure. Paper presented at the Annual National Gaming Council Symposium, Pittsburgh, October 1974.

Edwards, K. J., & DeVries, D. L. Learning games and student teams: Their effects on student attitudes and achievement. Center Report No. 148, Center for Social Organization of Schools, The Johns Hopkins University, Baltimore, Maryland, 1972.

Edwards, K. J., & DeVries, D. L. Effects of instructional games in the Teams-Games-Tournament structure: A comparative viewpoint of other research investigators. Paper presented at the Annual National Gaming Council Symposium Pittsburgh, October 1974.

Edwards, K. J., DeVries, D. L., & Snyder, J. P. Games and teams: A winning combination. Simulation and Games, 1972, 3, 247-269.

Edwards, W. The prediction of decisions among bets. Journal of Experimental Psychology, 1955, 50, 201-214.

Feather, N. T. Subjective probability and decision under uncertainty. In J. W. Atkinson and N. T. Feather (Eds.). A theory of achievement motivation. New York: John Wiley & Sons, Inc., 1966.

Fennessee, G. M., DeVries, D. L., & Edwards, K. J. Using Teams-Games-Tournament (TGT) in the classroom (2nd ed.). Center for Social Organization of Schools, The Johns Hopkins University, Baltimore, Maryland, 1974.

Hamblin, R. L., Buckholdt, D., Ferritor, D., Kosloff, M., & Blackwell, L. The humanization processes: A social, behavioral analysis of children's problems. New York: John Wiley & Sons, Inc., 1971.

Kagan, J. The poor are educable. The New York Times, 1974 (January 16).

McKeachie The decline and fall of the laws of learning. Educational Researcher, 1974, 3, 7-11.

Michaels, J. W. Classroom reward structure and academic performance. Center for Social Organization of Schools, The Johns Hopkins University, Baltimore, Maryland, Report #186, 1974.

Miller, L. K., & Hamblin, R. L. Interdependence, differential rewarding, and productivity. American Sociological Review, 1963, 28, 768-778.

Rotter, J. B. Clinical psychology. New Jersey: Prentice-Hall, Inc., 1964.

Slavin, R. E., & DeVries, D. L. Effects of team competition on race relations in the classroom: Further supportive evidence. Paper presented at the meeting of the American Psychological Association, Chicago, September 1975.

Walberg, H. J. Generalized regression models in education research, American Educational Research Journal, 1971, 8, 71-91.

Wodarski, J. S., Hamblin, R. L., Buckholdt, D., & Ferritor, D. Effects of individual and group contingencies on arithmetic performance. Paper presented at American Educational Research Association convention, New York, January 1971.

Table 1

General Linear Analysis on the Raw Scores of

The Stanford Achievement Test--2 x 2 Design

STANFORD ACHIEVEMENT TEST TOTAL SCORE

Independent Variables	Incremental R^2	df_2	F Ratio[1]
SAT Pretest (A)	.65	225	481.18**
CLASS ABILITY (B)	.02	224	16.22**
REWARD SYSTEM (C)	.01	223	5.64*
PRACTICE MODE (D)	.00	222	2.60
C X D	.00	221	< 1
A X C	.00	220	1.04
A X D	.01	219	6.25**

*$p < .05$

**$p < .01$

[1]The df_1 term for all F Ratios equals 1

Table 2

Treatment Group Means and Standard Deviations for

2 x 2 Design

Dependent Variable	TREATMENT CONDITION: Individual Competition, Individual Practice		Individual Competition, Group Practice		Team Competition, Individual Practice		Team Competition, Group Practice	
Stanford Achievement Test	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Pre	17.64	8.96	18.09	7.07	19.67	9.83	17.99	5.43
Post	19.20	9.65	19.80	6.52	22.69	9.35	20.55	5.76
Change	1.56		1.71		3.02		2.56	
	N = 59		N = 51		N = 59		N = 65	
Student Attitudes								
Perceived Prob.	14.45	2.84	14.26	2.25	14.77	2.43	14.67	2.52
Incentive Value	10.80	2.32	9.54	2.68	11.10	2.60	10.86	2.92
Peer Pressure	9.07	2.01	8.54	1.62	12.06	2.05	11.81	2.55
Satisfaction	16.27	4.02	16.02	4.05	15.88	4.16	17.17	3.65
	N = 56		N = 48		N = 54		N = 64	

Table 3

General Linear Analyses for Cognitive and Attitudinal Mediating Variables

2 x 2 Design

Source of Variance	Perceived Probability of Success			Incentive Value Success			Peer Pressure			Game Satisfaction		
	Incremental			Incremental			Incremental			Incremental		
	R^2	df_2	F Ratio[1]	R^2	df_2	F Ratio[1]	R^2	df_2	F Ratio[1]	R^2	df_2	F Ratio[1]
SAT PRETEST (A)	.00	209	< 1	.00	209	1.03	.00	209	< 1	.00	209	< 1
CLASS ABILITY (B)	.01	208	1.48	.00	209	1	.01	208	2.08	.01	208	2.08
REWARD SYSTEM (C)	.01	207	1.14	.02	207	5.44*	.35	207	119.25**	.00	207	1.07
PRACTICE MODE (D)	.00	206	< 1	.02	206	4.77*	.00	206	1.28	.01	206	1.38
C X D	.00	205	< 1	.01	205	1.78	.00	205	< 1	.01	205	1.26
A X C	.00	204	1.03	.01	204	1.21	.01	204	3.76	.02	204	5.26*
A X D	.00	203	< 1	.00	203	< 1	.00	203	< 1	.00	203	< 1

*p < .05
**p < .01

[1]The df_1 term for all F ratios equals 1.

Table 4

General Linear Analyses for SAT

Comparing Team Competition

with Control

Source of Variance	R^2_1	SAT TOTAL df_2	F^1
SAT PRETEST (A)	.61	169	259.39**
CLASS ABILITY (B)	.02	168	9.59**
TREATMENT (C)	.01	167	6.27*
A X C	.01	166	2.83
Total	.65		

*p < .05

**p < .01

[1]The df_1 term for all f-ratios equals 1.

Table 5

Treatment Group-Means and Standard Deviations

Team Competition versus Control

Dependent Variable	TREATMENT CONDITION TGT $\bar{X}$	TGT S.D.	CONTROL $\bar{X}$	CONTROL S.D.
Stanford Achievement Test				
Pre	18.72	7.69	21.00	7.83
Post	21.49	7.59	21.17	8.00
Change	2.77		.17	
	N = 116		N = 65	
Student Attitudes				
Perceived problem	14.72	2.47	12.73	2.61
Incentive value	10.96	2.78	8.95	2.30
Peer Pressure	11.92	2.34	7.52	2.06
Satisfaction	16.62	3.91	12.98	3.83
	N = 112		N = 60	

Table 6

Grand Linear Analyses of Student Attitudes

Team Competition versus Control

Source of Variance	Perceived Probability of Success			Incentive Value of Success			Peer Pressure			Game Satisfaction		
	Incremental R^2	df_2	F Ratio[1]	Incremental R^2	df_2	F Ratio[1]	Incremental R^2	df_2	F Ratio$_1$	Incremental R^2	df_2	F Ratio[1]
ABILITY (A)	.02	169	2.74	.00	169	< 1	.00	169	< 1	.01	169	1.83
CLASS ABILITY (C)	.00	168	< 1	.01	168	1.04	.00	168	< 1	.02	168	3.48
TREATMENT (C)	.11	167	20.94*	.14	167	27.56*	.47	167	146.65*	.15	167	30.17
A X C	.09	166	19.24*	.22	166	56.33*	.10	166	38.88*	.29	166	91.19
Total	.22			.37			.57			.47		

* $p < .01$

[1]The df_1 term for all F-Ratio equals 1.